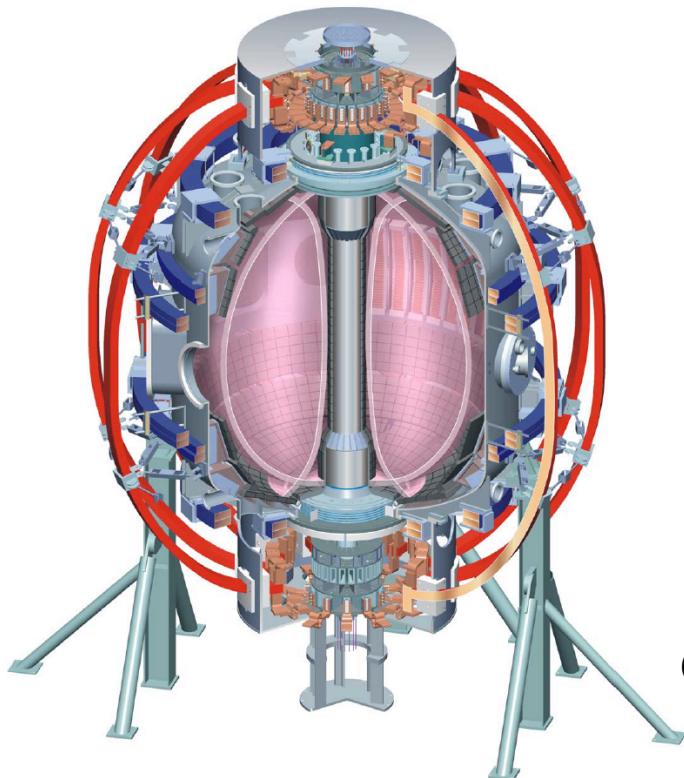


Supported by



# NSTX Facility/Diagnostics/Budget Update and Plan for FY 05 - 07 in Support of NSTX Research Plan



Masayuki Ono  
For the NSTX Team

March 15 - 16, 2005

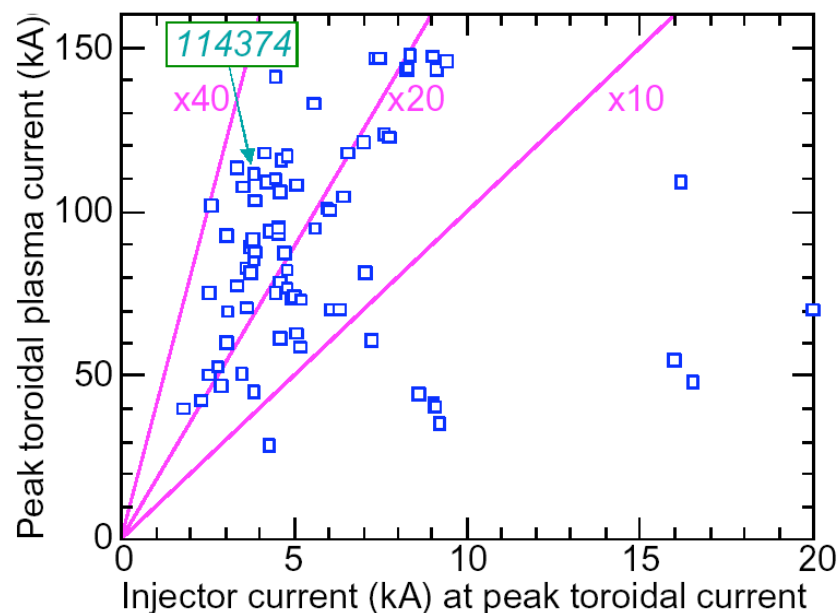
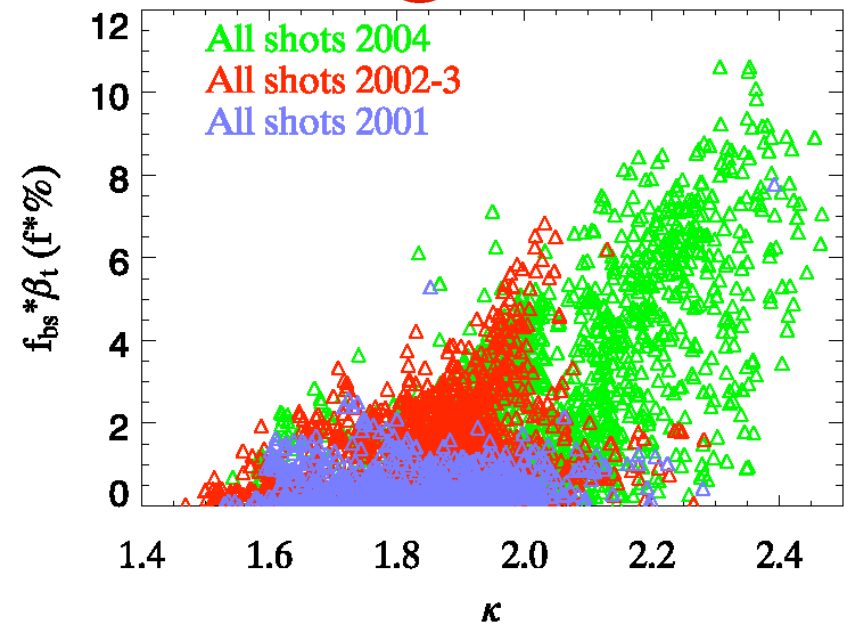
OFES Budget Planning Meeting

Columbia U  
Comp-X  
General Atomics  
INEL  
Johns Hopkins U  
LANL  
LLNL  
Lodestar  
MIT  
Nova Photonics  
NYU  
O Dominion U  
ORNL  
PPPL  
PSI  
SNL  
UC Davis  
UC Irvine  
UCLA  
UCSD  
U Maryland  
U Rochester  
U Washington  
U Wisconsin  
Culham Sci Ctr  
Hiroshima U  
HIST  
Kyoto U  
Kyushu U  
Kyushu Tokai U  
Niigata U  
U Tokyo  
JAERI  
Ioffe Inst  
TRINITI  
KBSI  
KAIST  
ENEA, Frascati  
CEA, Cadarache  
IPP, Jülich  
IPP, Garching  
U Quebec

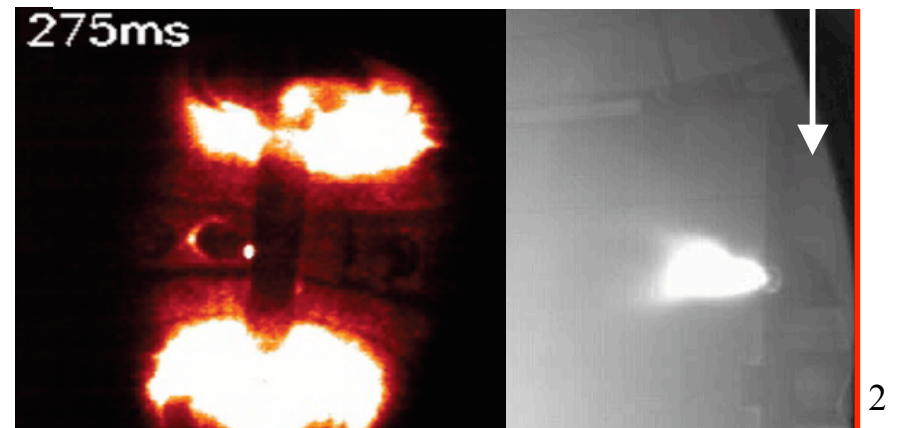
# Very successful FY 04 run with new facility tools



- o 21 run weeks achieved
- o Faster PCS enabled  $\kappa \sim 2.5$  plasmas with expanded operating regimes
- o rtEFIT (GA) with PCS controlled precise H-mode plasma shapes
- o Transient CHI (U. Wash) capacitor bank got current multiplication of 40



- o Particle recycling control tools - Li Pellet Injector and Supersonic Gas Injector (LLNL) introduced



# New Diagnostics Enhanced Analyses Capability in FY 04



## Kinetic Profiles

- 4ch MSE/CIF (Nova)
- Toroidal CHERS (51 channels)
- Edge Rotation Diagnostic

## MHD

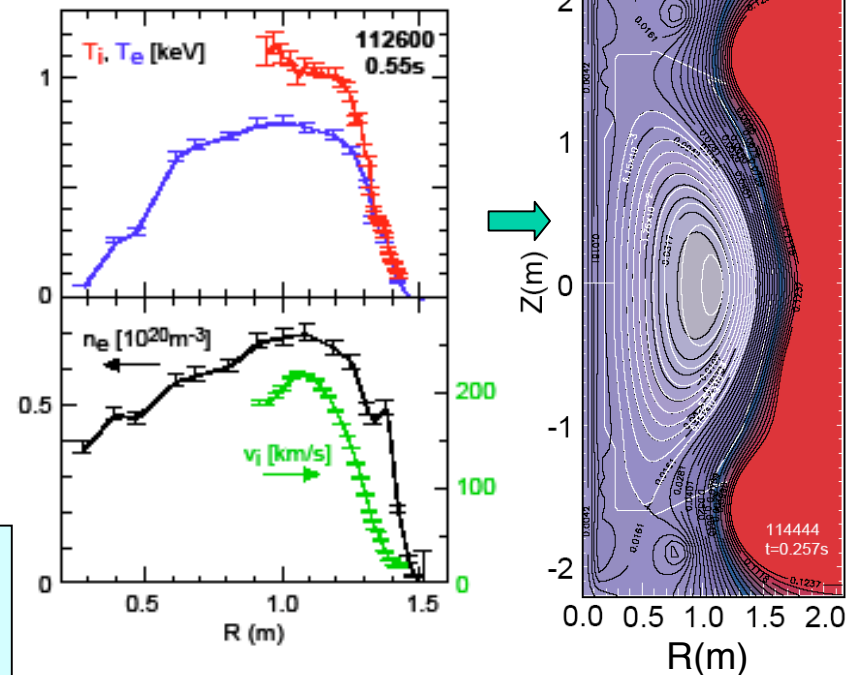
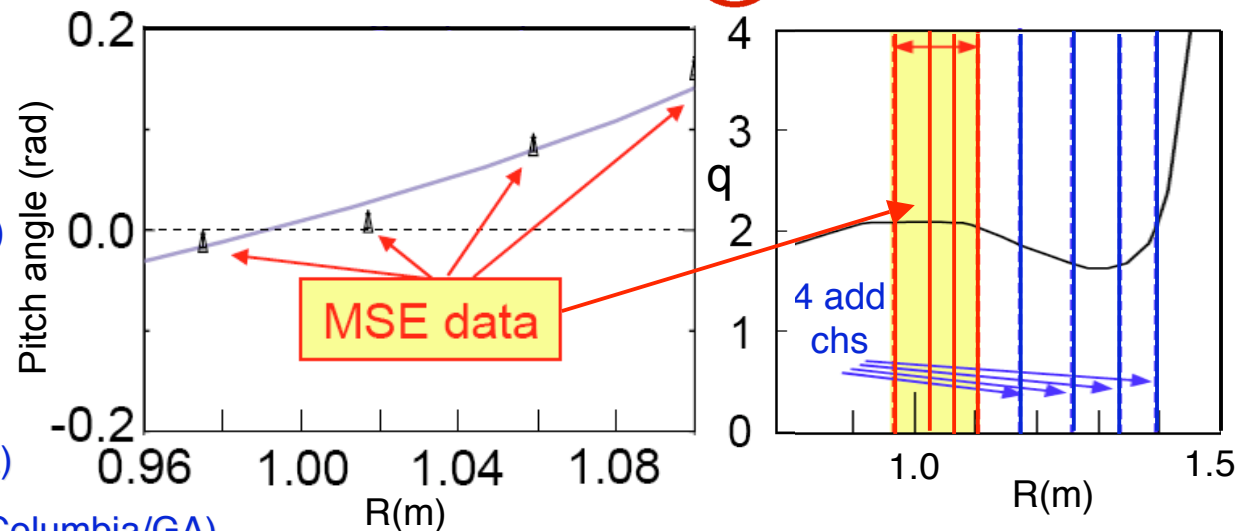
- Wall-mode sensors (Columbia)
- EFIT with Plasma Rotation (Columbia/GA)
- Fast X-ray camera (PSI)

## Energetic Particles

- Fast Lost Ion Probes (UCI,JAERI)

## Core/Edge Fluctuation

- Low k Reflectometer (UCLA)
- Fast Gas-puff Imaging(PSI, Nova Photonics)
- Fast divertor camera (Hiroshima U)

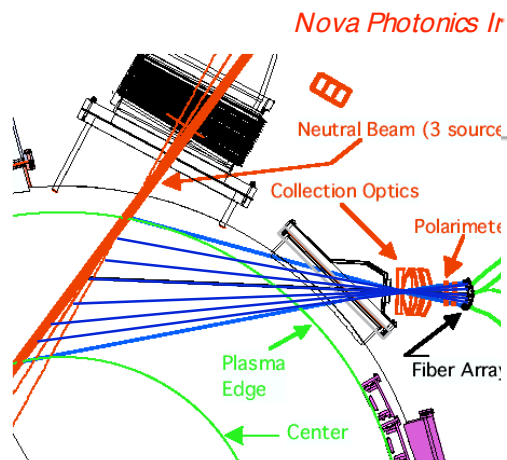


Preparations underway for the exciting FY 05 run

# Major Exciting New Tools for FY 05 Run

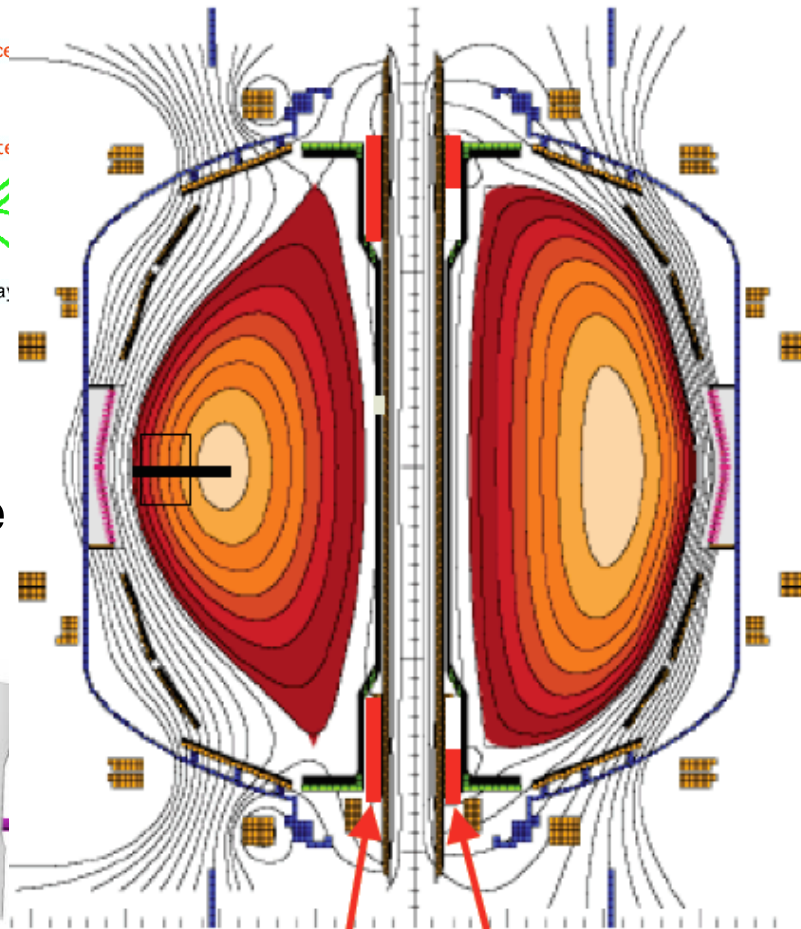


## 8 Ch MSE-CIF for $j(r)$

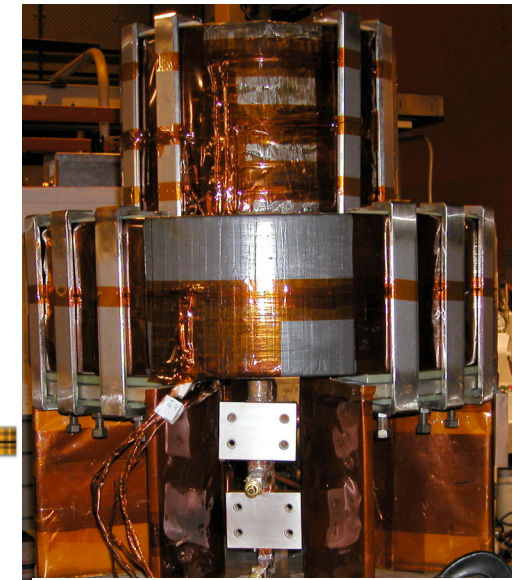


Achieved  
2004

Goal of  
2005 114465

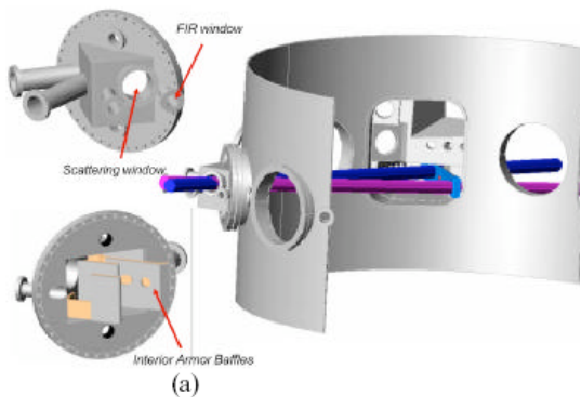


Old  
PF1A-L New  
PF1A-L

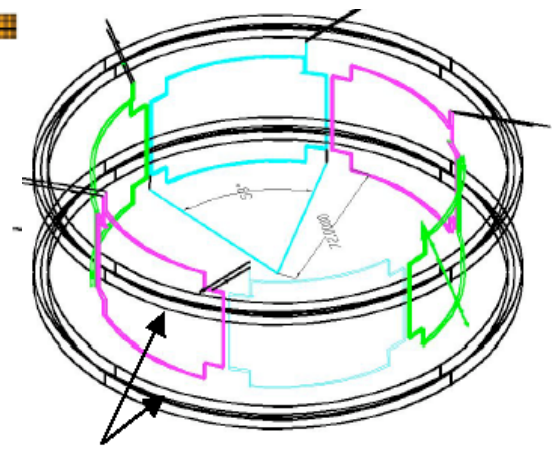


EF/RWM Coils

## Tangential Microwave High-k Scattering



UCD



PF5 coils (main vertical field)

Columbia



# Three Cases Considered for FY 06 - 07



	FY 05	FY 06	FY 07
<b>Case 1 (Base - Low)</b>	17 weeks		12 weeks
<b>Case 2 (Constrained)</b>	17 weeks	12 weeks	12 weeks
<b>Case 3 (Optimized)</b>	17 weeks	17 weeks	17 weeks

- Case 1- Base case causes delay of one year in experimental progress
- Case 2- Constrained case allows steady experimental progress
- Case 3- Optimized case allows good facility utilization and future investments

# Facility/Diagnostic Upgrades: CASE 1



Plasma Operations Weeks	FY 05	FY 06	FY 07
	17	0	12
MHD	● PF 1A Upgrade		
	● EF/RWM Coils with SPA		● Active EF Correction
T&T	● MSE/CIF 8 ch		● Interim P-CHERS
	● MPTS 30 ch		● Next-step fluctn diag prep
	● High k Microwave Scattering( UCD)		
Waves & Energetic Particles	● Wave Reflect (ORNL)		● Symmetric Antenna Feeds
	● EBW Radiometer		● Neutron Collimator
Solenoid-free Start-up	● ECH/Gas Injection Upgrade		
	● Dynamo-head-probe(UCSD)		
Boundary Physics	● Moveable GDC probe		● Lithium Evaporator
	● Dust Detector( $\Delta x \sim 25\mu$ )		● Fast IR Camera (ORNL)

- Significant staff reduction and drastic cut in non-labor funds in FY 06
- Eight months delay in experimental progress relative to case 2
- Maintain key personnel to resume operations in '07 (possibly '06)
- Perform maintenance/repair/upgrades utilizing key personnel

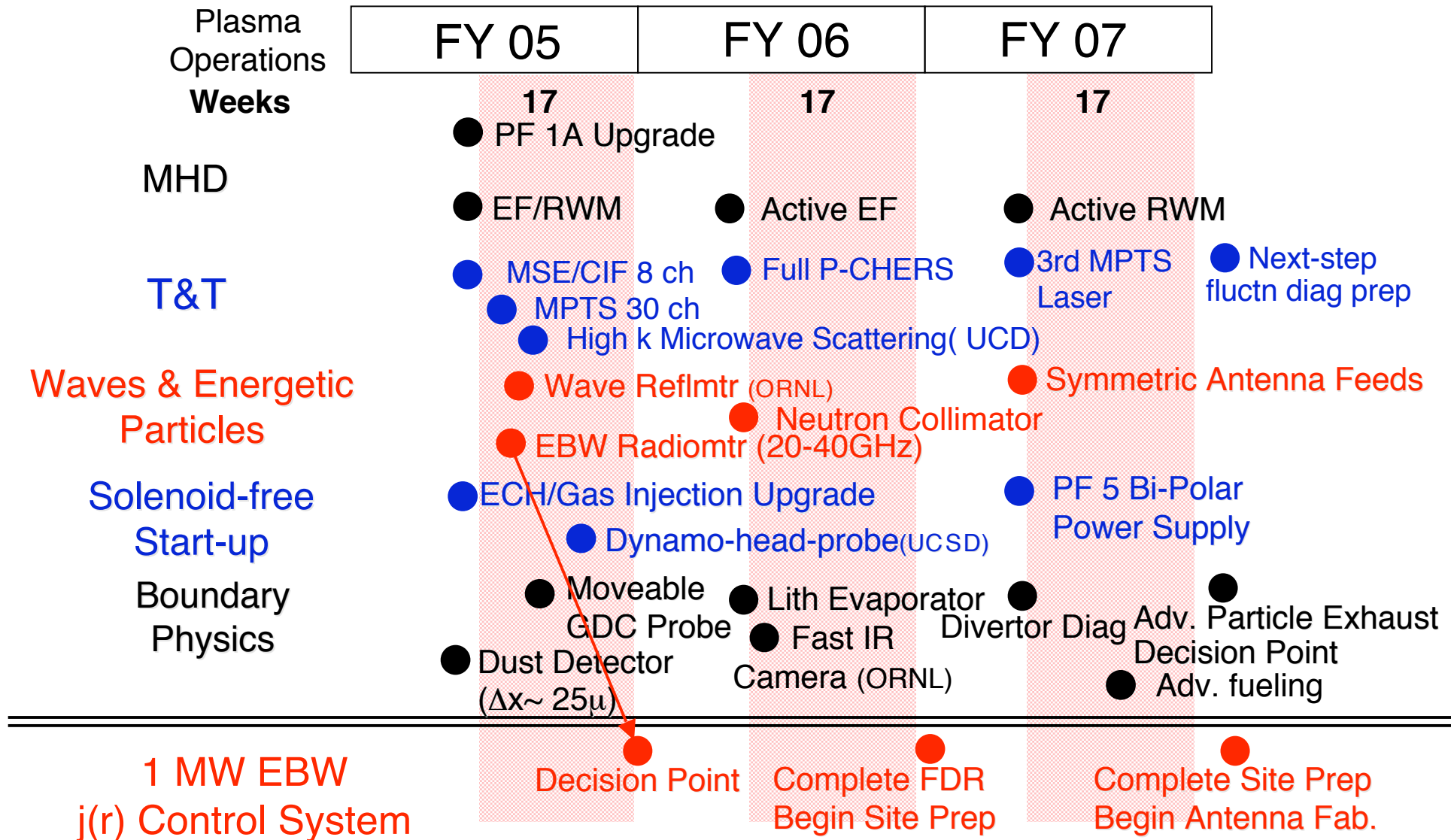
# Facility/Diagnostic Upgrades: CASE 2



Plasma Operations Weeks	FY 05	FY 06	FY 07
	17	12	12
MHD	● PF 1A Upgrade		
	● EF/RWM	● Active EF	● Active RWM
T&T	● MSE/CIF 8 ch	● Interim P-CHERS	● Full P-CHERS
	● MPTS 30 ch		● Next-step fluctn diag prep
	● High k Microwave Scattering( UCD)		
Waves & Energetic Particles	● Wave Reflmtr (ORNL)		● Symmetric Antenna Feeds
	● EBW Radiomtr (20-40GHz)	● Neutron Collimator	
Solenoid-free Start-up	● ECH/Gas Injection Upgrade		
	● Dynamo-head-probe(UCSD)		
Boundary Physics	● Moveable GDC probe	● Lithium Evaporator	
	● Dust Detector( $\Delta x \sim 25\mu$ )	● Fast IR Camera (ORNL)	

- Avoids eight month delay in case 1, enables steady progress in research
- Facility utilization emphasis with modest upgrades
- No large upgrades such as 1 MW EBW System

# Facility/Diagnostic Upgrades: CASE 3





# NSTX Budget Summary (\$M)



	FY 05	FY 06			FY 07	
Budget level	Base	Case 1 Base	Case 2 Request 1	Case 3 Request 2	Cases 1&2 Base	Case 3 Request
Run Weeks	17	0	12	17	12	17
Facility Operation	17.34	14.4	16.8	17.8	17.4	18.0
Facility Upgrades	1.10	0.8	1.0	2.0	1.0	2.5
<b>Facility Total</b>	<b>18.44</b>	<b>15.2</b>	<b>17.8</b>	<b>19.8</b>	<b>18.4</b>	<b>20.5</b>
PPPL Research	9.64	9.4	9.9	10.0	10.2	10.3
Diag Upgrades	0.73	0.6	0.8	1.2	0.8	1.1
Coll. Diag. Interf	0.65	0.5	0.6	0.6	0.6	0.7
Collaborations	5.13	5.0	5.1	5.5	5.4	5.5
<b>Science Total</b>	<b>16.15</b>	<b>15.5</b>	<b>16.4</b>	<b>17.2</b>	<b>17.0</b>	<b>17.6</b>
<b>NSTX Total</b>	<b>34.59</b>	<b>30.7</b>	<b>34.2</b>	<b>37.0</b>	<b>35.4</b>	<b>38.1</b>

- No run week case1 in FY 06 results in ~ 18 % staff reduction from FY05
- 12 run week case 2 in FY 06 and 07 emphasizes facility utilization
- 17 run week case 3 in FY 06 and 07 includes 1 MW EBW Upgrade

# FY07 Facility Utilization Emphasis Cases



## FY 2007 (\$M)

Run Week	0	6	12	16	20	25
Facility	15.9	17.8	18.5	19.0	19.5	20.2
Science	16.0	16.8	16.9	17.1	17.4	17.8
NSTX Total	31.9	34.6	35.4	36.1	36.9	38.0

- No run week case retains critical staff and maintenance performed for operations
- No run week case also assumes 10% reduction of staff from the 12 week case
- 6 run week case restores the needed staff level for operations
- Incremental funding covers consumables, very small staff increase, maintenance and spare parts needs, and modest upgrades to maintain research productivity
- Incremental increase in collaboration funding
- High Power EBW system not included

# Incremental Funding - Case 3 - will Greatly Enhance NSTX Science Output



- **Significantly increase Facility Utilization:**
  - 17 run weeks in FY 06 and FY07 (~ 40% increase from Case 2)
- **Improve Facility/Diagnostic Capabilities:**
  - Implement Advanced Fueling (FY07)
  - Outer PF Start-up System (FY 06)
  - Full P-CHERS (FY06)
  - Implement Critical Boundary Physics Diagnostics (FY 07)
  - Third laser for MPTS to improve time resolution (FY 07)
  - Start construction of EBW 1MW System (FY 06 - 08)
- **Improve Facility Reliability and Availability**
  - Better Preventative Maintenance and
  - Critical spare parts

# Facility and Budget Summary



- Very successful FY04 operations with 21 run weeks:
  - Faster plasma control system allowed higher elongation, new regimes
  - Many new capabilities introduced - 4 ch. MSE-CIF, lithium pellet injector, supersonic gas injector, fast x-ray camera, divertor fast camera
- Planning for exciting FY05 run with new capabilities:
  - 17 run weeks to start in April to August, September as contingency
  - New facility upgrades: New PF 1A coils, EF/RWM coils powered by 3 ch. SPA, ECH/Gas CHI Injector, Moveable GDC
  - New diagnostic upgrades; High k scattering, 30 ch. MPTS, 8 ch. MSE-CIF, Wave Reflectometer, EBW Radiometer, Dynamo CHI probe, Dust Detector
- Three cases presented for FY06 and FY07
  - Case 1 (Base - 0, 12 weeks) causes eight months delay in experiments
  - Case 2 (12, 12 weeks) allows steady facility utilization with some upgrades
  - Case 3 (17, 17 weeks) allows good facility utilization and incorporates required upgrades identified in 5 year plan

In Cases 2, 3, NSTX contribute significantly more to Advance Toroidal Plasma Science, Burning Plasma Physics, and Configuration Optimization